DISTRIBUTION AND ABUNDANCE OF JUVENILE COHO AND STEELHEAD IN GAZOS, WADDELL AND SCOTT CREEKS IN 2001

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31 December 2001

ABSTRACT: In September and October 2001 previously sampled representative sites on Gazos Creek and Waddell Creek and in the Scott Creek watershed were evaluated for habitat conditions and sampled by electroshocker to assess distribution and abundance of steelhead and 2001 year class coho. Juvenile coho were absent in Gazos Creek, and were present in Waddell and Scott creeks as only a few individuals at 2 and 4 sites, respectively. The 2000 and 2001 year classes are presently not viable south of San Francisco, and their recovery will probably require several cycles of hatchery intervention.

Steelhead abundance in Gazos Creek was similar to previous years, although yearling abundance was higher than in 1998-2000. Abundance on Scott Creek was somewhat lower than most previous years. Waddell Creek steelhead were at less than half strength for the third year in a row, primarily due to low numbers downstream of the East and West forks. Densities were very low immediately downstream of the forks and increased only in the lower half of the main stem. Densities were also depressed on sites on the East and West forks. The fish kill effects were similar to 2000, but somewhat less severe than in 1999.

Fall sampling of juveniles has been a relatively low effort means of assessing status of coho and steelhead in these streams. Mortality among captured fish has been less than 2%, and the population impact of sampling 5-10 % of the habitat has been negligible.

INTRODUCTION

Since all wild female southern coho (*Oncorhynchus kisutch*) spend one year in the stream and two years in the ocean prior to spawning (Shapovalov and Taft 1954), at least 3 years of study are necessary to determine the status of the three numerically independent year classes. This report presents the results of the tenth consecutive year of sampling for juvenile coho and steelhead (*O. mykiss*) on Scott, Waddell and Gazos creeks. These three cycles of juvenile sampling have demonstrated the importance of winter weather upon coho abundance. Juvenile coho were very scarce in all three streams in 1998, due to the impacts of El Nino storms (Smith 1998c), so sampling in 2001 was important to determine whether any adult returns occurred from the extremely weak year class.

Previous surveys have shown wide year-to-year variation in coho abundance within these streams (Smith 1992-2001; Smith and Davis 1993). No coho were captured in 1994, 1997 and 2000 in Waddell Creek (Santa Cruz County) and in 1997 and 2000 in Gazos Creek (San Mateo County) (Gazos Creek was not sampled in 1994). Coho were very rare in Waddell and Gazos creeks in 1992, 1995 and 1998 and in Scott Creek (Santa Cruz County) in 1992, 1994, 1998 and 2000. Coho abundance in Scott Creek had rebounded in 1995 and 1997 due to spawning by precocial (2-year old) hatchery-reared females (Smith 1995b and 1998a). However coho were severely impacted in 1998 and 2000 by the 1998 El Nino storms (Smith 1998c and 2001). Similar situations occur elsewhere on the coast, including Redwood Creek in Marin County, where the 1988, 1994 and 2000 years classes were less than 5-10 percent as abundant as other year classes (Smith 2000). These wide coho year to year abundance differences occur because the restricted early spawning period, single spawning attempt, and rigid ages of smolting and spawning (Shapovalov and Taft 1954) make them susceptible to drought, floods or other "disasters" within small watersheds (Smith 1994c). Steelhead, however, have extended spawning periods, can spawn more than once, and are variable in their ages of smolting and maturation (Shapovalov and Taft 1954). Therefore, steelhead juvenile abundance is more likely to indicate yearly rearing habitat quality. In addition, their populations are less affected by, and recover quickly from, bad years. Steelhead juvenile numbers in the same streams have been quite stable (Smith 1992-2001; Smith and Davis 1993).

METHODS

In September and October 2001 twelve previously sampled Scott Creek watershed sites were sampled by electroshocking (Table 1). The 2 sites not sampled, on upper Scott Creek and on upper Big Creek, were unlikely to have coho because of their absence at adjacent, more favorable sites. In September and October ten previously sampled sites on Waddell Creek were sampled (Table 2). Two sites on the upper west fork and one site on the upper east fork were not sampled because of difficult access and because of lack of coho at adjacent downstream sites. In September ten previously sampled sites on Gazos Creek were sampled (Table 3). A steeper, previously sampled, site was not sampled in 2001 because of lack of coho all other, more suitable, sites.

At sampled sites on each stream the same habitats were sampled as in previous years if possible. The length of stream sampled per site was similar to previous efforts (Table 4). The relative abundance of sampled habitats was generally similar to previous years, but also reflected the increase in pool abundance that occurred with scour and wood input during1998 El Nino storms (Table 4) (Smith 1998a).

The primary goal of the sampling by electroshocker was to look for the presence and abundance of coho, so sampling since 1992 has concentrated on pool and glide habitats, and riffles were seldom sampled. At each site usually 3 to 5 individual habitat "units" (a glide or pool, with its contiguous glide and run habitat) were blocknetted and sampled by 2 to 3 passes with a backpack electroshocker (Smith-Root Type 7, smooth pulse). Sampled habitats were representative of those available, except for Waddell Creek, where

scarce large, deep pools on the main stem could not be sampled by electroshocking. Length, width, depth, cover (escape and overhead), and substrate conditions were determined, and percentage of habitat types assigned for each habitat unit. Rosgen channel types were determined, and relative abundance of pool, glide, run and riffle habitat types estimated for the vicinity of each site (Tables 1-3).

Juvenile fish were measured (standard length, SL) in 5 mm increments, and young-of-year (YOY) steelhead were separated from older fish, based upon length-frequency at each site. Mortality was kept to a minimum by reducing electroshocker voltage (400-200 V) in shallow water and by immediately placing captured fish in a floating live car. Mortality was recorded at the time of length measurements.

RESULTS AND DISCUSSION

Habitat Conditions in 2001

Winter flows in 2000/2001 were relatively mild, and no significant changes in channel configuration or pool frequency, depth or complexity occurred in 2001 on any of the three streams. Almost no new wood was added in 2001.

On all three streams substantial wood was added in 1998 (Smith 1998c), and large wood was reworked during large storms in 1999 and 2000. However, little was added over the last 3 winters or during the 1992-1997 period. Large wood additions, especially from long-lasting conifers, apparently occur episodically only during extremely wet years, when numerous landslides deposit upslope trees in the channel, and frequent large floods erode stream banks and topple large riparian trees. Some smaller streamside alders are added to the channel in most average or wet years, but they easily rearrange and break up quickly; habitat benefits, although important, are smaller and of rather brief duration.

Winter storms ceased early in 2001 and stream flows declined quickly in spring. However, the summer was relatively cool. After the quick early decline, stream flows declined much more slowly and were not especially low in September.

The amount of fine sediment present in late summer appears to have increased in Waddell and Scott creeks in recent years. Streambed and bank rooting by feral pigs has substantially increased in the last 3 years, and is probably a major factor in the increase in fine sediment.

Coho

Scott Creek Watershed. Only 12 coho were captured at 4 sites on Scott Creek downstream of Mill Creek in 2001 (Table 4). The apparent low density of juveniles, scattered over two miles of stream, is the pattern that might be expected if fry from as few as a single redd were dispersed by high stream flows. However, late winter and

spring stream flows dropped quickly in 2001, and probably would not have caused passive dispersal. Alternatively, the pattern may be due to poor egg survival in several scattered redds. The winter flows should not have damaged redds in 2001. However, the generally poor substrate conditions in lower Scott Creek, together with low flows over and through the redds, could have produced poor egg survival or fry emergence.

Few (or possibly no) returning adults in 2000-2001 should have resulted from the very low number of juveniles produced in 1998 (Smith 1998c). However, precocial returns of hatchery-reared fish from the strong 1999 year class may have spawned in 2001.

At the present time only one of the three year classes (1999) in Scott Creek appears viable, and all coho restoration on Scott Creek, and on other streams south of San Francisco, may have to be rebuilt from that year class.

Waddell Creek. Only 13 juvenile coho were captured at two West Fork sites in 2001. The sites are only 0.6 miles apart, and the juveniles could have resulted from as few as one spawning pair of coho.

As in Scott Creek, very low coho production in 1998 should have produced few or no returning adults in 2001. Spawning may have been by precocial hatchery-reared fish straying from Scott Creek.

Although juvenile coho have been captured in 2 of the last 3 years, they were common only in 1999 (Smith 1999).

Gazos Creek. No coho were captured in Gazos Creek in 2001, despite sampling of suitable pools at ten sites throughout the stream. The absence of coho was not surprising, as the very low densities found in 1998 (Smith 1998c) were likely to have produced few or no returning adults. Coho have been captured at Gazos Creek in only one of the last three years, in 1999 (Smith 1999 and 2001).

Steelhead

Scott Creek. YOY steelhead abundance in the Scott Creek watershed was relatively low compared to previous years (Table 5), averaging only 52 fish per 100 feet of sampled habitat. YOY steelhead from the 1993 and 1996 year classes were less abundant, but in those years coho were very abundant and apparently suppressed YOY steelhead in pools and glides. Although continuous surface flow persisted at all sites through October, the early decline in stream flow probably substantially reduced YOY steelhead; stream flows were low all summer on Scott Creek upstream of Big Creek. Lowest densities were on the very heavily shaded sites or portions of sites on lower Scott Creek (site A) and on upper Scott Creek (sites 5, 7 and 11), where the combination of very low stream flows and low light levels limit insect production and ability of YOY steelhead to feed.

YOY steelhead sizes normally vary among sites, with fish at the two sites downstream of Big Creek being larger than at sites upstream of Big Creek, where stream flows are much

lower (Figures 1 and 3). In addition, shaded low flow sites on upper Scott Creek and on Mill Creek tend to have smaller fish than other Scott Creek and Big Creek sites (Figures 1 and 3). In 2001 YOY steelhead were somewhat smaller than in 1995-2000 at lower and middle Scott Creek sites (Figures 1 and 3), apparently due to the early spring and summer decline in stream flows. In very wet years, like 1995 and 1998, those same sites have reared slightly larger fish (Figure 3). Heavily shaded upstream sites don't appear to show any growth response to annual flow conditions (Figure 3), apparently because later fry emergence upstream usually occurs after stream flows have declined.

Yearling steelhead on Scott Creek have generally been less abundant in years of heavy storm flows, such as 1995 and 1997 – 2000 (Table 5). The declines might be due to poor overwinter survival and/or to improved spring growth resulting in smolting by yearlings. However, yearling abundance in 2001 continued to be relatively low, despite the mild winter and low spring stream flows.

Waddell Creek. For the third year in a row overall steelhead density on Waddell Creek has been very low (Tables 2 and 5). In all three years densities downstream of the forks have been extremely depressed (Tables 2 and 6), with YOY densities at all sites at least 20 % percent below previous low years and 40 % below the 1995-98 means. In 1999 YOY steelhead densities were reduced more than 80-90 percent from the middle of Camp Herbert downstream to (and probably including) the lagoon. In 2000, densities were somewhat better, but still 58-88 % below the 1995-98 means. In 2001, the 3 most downstream sites were similar to 2000, but the 3 sites immediately downstream of the forks had densities of less than 1-13 % of 1995-98 means. In addition, densities were substantially depressed at one East Fork and two West Fork sites (Tables 2 and 6). The apparent declines at these additional sites may be due to impacts similar to those affecting main stem sites, or may reflect low adult numbers in 2001, due to 1999 and 2000 impacts.

Overall yearling densities for the last 3 years have been impacted less than that of YOY, but still have been only about half of those seen in 1997 and 1998 (Table 5)

The loss of YOY steelhead from the main stem has even greater potential impact than the density declines indicate. Main stem steelhead regularly grow much faster than those in the forks (Smith 1998c and Figure 2), resulting in smolting of many of the fish as yearlings. In addition, if the apparent fish kill extends to the lagoon, as appears likely in at least 1999, that would result in a substantial loss of potential smolts, as the lagoon normally produces numerous, very fast growing steelhead (Smith and Davis 1993; Smith 1996b and 1997).

Gazos Creek. YOY steelhead density in Gazos Creek in 2001 was actually slightly higher than the 1992-2000 mean (Table 5). As in previous years, densities were relatively low downstream of Old Woman Creek (Table 3), where turbidity and fine sediment appear to be a problem in many years (Smith 1996 and 1998c). In addition, densities were unusually low at the uppermost sample sites in 2001. In general YOY

steelhead densities have tended to be lower at sites and habitats with very dense (> 90-95 %) canopy.

On Gazos Creek there has usually been a gradual increase in YOY steelhead size between sites 1 (channel mile 0.9) and 3 or 4 (3.15 or 4.4 miles) and little change further upstream (Figure 2, 4 and 5). The size gradient may reflect warmer water and earlier fry emergence downstream. YOY sizes downstream of Old Woman Creek vary among years (Figure 6), probably due to both stream flow and substrate conditions. In 1998 fish were generally smaller, despite high summer stream flows, due to abundant fine sediment (Smith 1998c). In 1995, 1999 and 2000 stream flows and substrate conditions were relatively good and fish were larger. Fish were relatively small in 2001, apparently because of early declines in stream flows. At upstream sites on Gazos Creek YOY steelhead generally are both small and show little size change among years (Figure 6); however fish throughout Gazos Creek were generally larger in 2000 (Figures 2, 4 and 5).

As seen in Scott Creek, yearling steelhead densities in Gazos Creek were relatively low in 1997-2000 (Table 5), years of heavy winter storms. Yearling abundance rebounded in 2001, apparently because of the mild winter.

MANAGEMENT IMPLICATIONS

Coho

The situation for coho in these three streams is somewhat worse than, but similar to, that of 1992-1994. Only a single strong year class is present (the 1993,1996,1999 year class). The other 2 year classes are either gone (2000 and 2001 year classes for Gazos Creek and 2000 year class for Waddell Creek) or very weak (2000 and 2001 year classes for Scott Creek and the 2001 year class for Waddell Creek). The single strong year class (1993) on Scott in the earlier period was able to rebuild the other two because accelerated growth of hatchery-reared coho produced precocial (2-year old) spawning females. The role of hatchery rearing again appears crucial to rebuilding 3 viable year classes.

Alternatively, if the single strong year class is crippled or eliminated by floods in 2001/2002, coho will be essentially extirpated south of San Francisco Bay. Summer rearing conditions for coho are suitable in the 3 streams, which have cool, flat habitat. In addition, pools are frequent on Scott and Waddell creeks. However, drought in 1991, when adult access wasn't possible until March, and floods in 1992, 1995, 1997, 1998 and 2000, which destroyed many redds and reduced overwinter survival, have nearly eliminated coho. These drought and flood impacts apparently extend widely in central California, as Redwood Creek in Marin County also has one very weak year class (1988, 1994 and 2000) (Smith 2000). Most alarmingly, a single extreme winter, like 1998, may weaken or eliminate 2 year classes, by impacting overwintering juveniles and by also destroying redds.

Steelhead

Although also federally listed as threatened, steelhead in these streams appear to be doing well. Only the apparent fish kills on the main stem of Waddell Creek in 1999, 2000 and 2001 raise concern. Densities have fluctuated by only a factor of about 2 from year to year (Table 5), generally increasing in years of higher summer stream flow. Late-spawning steelhead have apparently not been impacted by floods as have coho. Fish at upstream shaded, low summer flow sites have generally been smaller than fish at downstream sites in Waddell and Scott creeks; Gazos Creek fish have been similar in size to upstream sites on the other two streams. Little size change in YOY fish has occurred between wet and dry years, except at downstream sites or with large summer flow increases or decreases. For most sites the strongest effect of summer stream flow appears to be on density, rather than on growth rate.

Monitoring

Fall monitoring of juveniles at representative, repeatable sites on the three streams has required about 200-250 man hours per year (using a 2-person sampling team) and has provided a valuable index to steelhead and coho status. Electroshocking is the only effective way to sample juveniles at many of the sites, because snorkeling would not be effective in shallow, small or complex habitats or at heavily shaded sites. Mortality from electroshocking has been low, averaging 0.6 % among captured steelhead and coho in four streams in 2001 (Table 7). Mortality in previous years has been similar, although it has exceeded 2 % in deeper, complex habitats or under warmer water conditions (Smith 1996-1999). In addition, since only 3-10 % of the habitat is sampled, the loss to the total stream population is less than 0.1%.

Trapping of adults or smolts on these streams would provide valuable abundance data for other important life history stages. However, it would also probably require very expensive permanent weirs, and/or provide relatively inaccurate data. Trapping would be inefficient during much of the high-flow adult migration period and during the variable early portion of the smolt migration period. Past experience on Waddell Creek has indicated that much of the adult or smolt migrations occurs during high flow events, when simple trap systems fished poorly (Smith 1992).

ACKNOWLEDGMENTS

Bob Briggs, Bud McCrary and Dr. Wally Mark gave permission to sample sites on Waddell and Scott creeks. The California Department of Parks and Recreation gave permits for sampling on Waddell and Gazos creeks. Ruth Sundermeyer, Jerry Sanchez, Jae Abel and Michelle Leicester assisted with the electroshocking.

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Table 1. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet ( ) at sites on Scott Creek in September and October 2001. (Site #s agree with earlier reports).

Site	Mile >Hwy1	Chan Type	%Habitat Available				% Habitat Sampled				Sample Length (Feet)	#SHT		Coho
			PL	GL	RN	RF	PL	GL	RN	RF		+0	+1	
A Near Diversion	0.9	C3	40	40	15	5	84	16	–	–	153	33 (22)	4 (3)	4 (3)
1 < Little Creek	1.9	C3	50	25	20	5	70	36	14	–	217	125 (66)	6 (3)	4 (2)
Big Creek	2.15													
2 Pullout > Big Creek	2.55	C4	50	30	15	5	89	11	–	–	220	136 (73)	16 (8)	2 (1)
3 < Mill Creek	3.05	C4	50	30	15	5	66	34	–	–	143	94 (73)	7 (6)	2 (1)
4 < Swanton Road	3.55	C4	50	30	15	5	56	44	–	–	162	121 (83)	15 (10)	–
5 Cattle guard	4.25	C4	50	30	15	5	79	17	4	–	212	52 (27)	28 (14)	–
7 Pullout < Big Cr. Gate	4.9	C4	50	30	15	5	92	8	–	–	185	40 (22)	13 (7)	–
9 0.15 mile > bridge	5.15	B4C	45	25	20	10	71	29	–	–	119	55 (54)	10 (9)	–
11 Upper Ford	5.85	C3	50	30	15	5	85	12	3	–	266	34 (13)	10 (4)	–
12 Big Creek/ Swanton Road		C3	30	15	40	15	95	–	–	5	95	91 (72)	17 (13)	–
12A Big Creek < Hatchery		B3	35	10	40	15	88	12	–	–	85	47 (56)	6 (7)	–
13 Mill Creek <Swanton Road		C3	50	20	20	10	100		–	–	121	76 (67)	16 (13)	–
Totals											2024	904	148	12
Mean of 12 Sites			47	26	20	7	80	18	2	–		(52)	(8)	(0.6)

Table 2. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet ( ) at sites on Waddell Creek in September and October 2001. (Site #s agree with earlier reports).

Site	Mile >Hwy1	Chan Type	%Habitat Available PL	GL	RN	RF	% Habitat Sampled PL	GL	RN	RF	Sample Length (Feet)	#SHT +0	+1	COHO
1 First bridge	0.6	C4	50	30	15	5	92	8	--	--	193	70 (38)	11 (6)	--
2 < Alder Camp	1.35	C4	50	35	10	5	80	9	8	4	225	112 (54)	9 (4)	--
3 Twin Redwoods	1.8	C4	50	30	15	5	63	30	5	1	204	52 (27)	11 (5)	--
4 Periwinkle	2.2	C4	45	30	20	5	84	16	--	--	101	1 (1)	0 (0)	--
5 Pullout < Herbert	2.6	C3	55	25	15	5	75	10	--	16	154	15 (10)	1 (1)	--
6 Camp Herbert	3.1	C3	50	25	15	10	75	8	--	16	338	33 (10)	17 (5)	--
7 E Fork > Ford	3.2	C3	45	25	20	10	90	10	--	--	255	52 (21)	3 (1)	--
8 W Fork	3.3	C4	40	30	25	5	76	16	3	5	299	40 (14)	9 (3)	6 (2)
9 Mill Site	3.9	C4	45	30	15	10	87	9	4	--	263	50 (20)	9 (4)	7 (3)
10 Tributary @ Bridge	4.7	C3 C1	40	30	20	10	75	22	3	--	202	76 (42)	12 (6)	--
Totals											2234	501	82	13
Mean of 10 Sites			46	29	17	8	81	14	2	3		(24)	(4)	(0.5)

Table 3. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet ( ) at sites on Gazos Creek in September 2001. Site #s agree with earlier reports.

Site	Mile >Hwy1	Chan Type	%Habitat Available				% Habitat Sampled				Sample Length (Feet)	#SHT		COHO
			PL	GL	RN	RF	PL	GL	RN	RF		+0	+1	
1	0.9	C4	40	30	20	10	76	24	--	--	213	48 (23)	22 (10)	--
2	1.8	C4	35	25	25	15	91	9	--	--	164	52 (33)	17 (10)	--
Old Woman Creek	2.05													
2A	2.1	C4	35	30	20	15	83	17	--	--	185	87 (52)	26 (14)	--
2B (G/H)	2.8	C4	40	25	25	10	75	25	--	--	124	45 (42)	6 (5)	--
3 (<J)	3.15	B4C	40	25	25	10	50	31	18	2	240	138 (63)	21 (9)	--
3A (N)	3.9	B4C	40	30	20	10	85	15	--	--	200	125 (71)	22 (11)	--
4	4.4	B4C	45	25	20	10	76	20	4	--	177	107 (73)	21 (12)	--
4A	4.6	B4C	35	35	20	10	69	31	--	--	65	29 (49)	10 (16)	--
5	4.85	B4C	40	25	25	10	91	9	--	--	131	24 (21)	10 (8)	--
7A (>U)	5.3	B1	40	10	35	15	70	27	2	--	292	55 (20)	31 11)	--
Totals											1791	710	186	0
Mean of 10 Sites			39	26	24	12	77	21	2	0.2		(45)	(11)	0

Table 4. Number of sites, amount and type of habitat sampled, number of coho collected and estimated density (per 100 feet) for Scott, Waddell, Gazos and Redwood creeks in 1988 and 1992 – 2001.

Stream and Date	Number of Sites Sampled	Length (feet)	Habitat Percent PL	GL	RN	RF	% of Sites with Coho	# of Coho	Coho Density (/100')
Scott Creek									
Jul – Sep 1988	14	3535	41	25	21	12	84	384	15.5
Aug – Oct 1992	13	1624	66	30	4	0	46	42	4.3
Jan 1994	11	1554	49	32	19	0	100	376	27.2
Aug 1994	13	1744	59	36	6	0	46	17	1.1
Oct 1995	12	1686	59	32	8	1	92	223	14.2
Oct – Nov 1996	12	1684	62	30	8	1	100	473	33.0
Aug – Sep 1997	13	1865	64	24	11	0	62	145	9.3
Sep – Oct 1998	11	1753	77	16	6	1	64	34	1.8
Oct 1999	10	1430	81	17	2	0	90	328	29.2
Sep – Oct 2000	10	1810	81	13	6	0	40	7	0.4
Sep – Oct 2001	12	2024	80	18	2	0	33	12	0.6
Waddell Creek									
Jun – Aug 1988	8	1817	54	19	23	5	63	19	1.3
Jul – Aug 1992	13	2858	67	31	2	0	38	19	0.6
Oct – Dec 1993	12	1857	38	21	28	14	75	58	3.6
July 1994	12	2367	66	24	7	2	0	0	0
Sep 1995	12	2498	64	24	10	2	58	24	1.1
Aug – Sep 1996	14	2491	69	21	8	2	93	302	12.5
Aug – Sep 1997	11	1873	58	32	8	1	0	0	0
Sep – Oct 1998	10	2083	76	18	5	1	20	7	0.3
Oct 1999	10	1558	78	19	4	0	40	66	3.1

Table 4 (continued)

Stream and Date	Number of Sites Sampled	Length (feet)	Habitat Percent PL	GL	RN	RF	% of Sites with Coho	# of Coho	Coho Density (/100')
Sep 2000	8	1511	65	19	13	3	0	0	0
Sep – Oct 2001	10	2234	81	14	2	3	20	13	0.5
Gazos Creek									
Aug 1992	2	275	44	56	0	0	0	0	0
Jan 1994	4	503	65	22	12	1	50	9	2.2
Nov 1995	4	425	58	19	21	3	25	1	0.2
Sep 1996	5	830	49	27	12	13	100	33	4.9
Aug 1997	5	827	45	28	17	10	0	0	0
Aug – Sep 1998	8	1529	65	14	11	10	25	10	0.4
Sep – Oct 1999	9	1475	79	18	2	1	67	79	6.2
Sep – Oct 2000	7	1036	75	15	10	0	0	0	0
Sep 2001	10	1791	77	21	2	0	0	0	0
Redwood Creek									
Jun – Sep 1992	4	1032	37	40	5	7	100	426	45.3
Jun – Aug 1993	4	951	48	25	18	9	100	355	46.3
July 1994	7	1287	58	25	12	6	43	24	1.9
Aug 1995	4	796	41	30	19	10	100	308	42.0
Nov 1996	3	604	51	31	11	7	100	214	38.8
Sep – Oct 1997	5	984	72	18	9	1	60	209	23.3
Oct 1998	5	1174	59	25	15	1	100	327	31.6
Oct 2000	6	1077	71	27	3	0	33	14	1.1
Oct 2001	5	956	78	15	0	7	60	242	26.8

Table 5. Number of sites, amount and type of habitat sampled and estimated density (per 100 feet) of steelhead for Scott, Waddell, Gazos and Redwood Creeks in 1988 and 1992 – 2001.

Stream and Date		Number of Sites Sampled	Length (feet)	Habitat Percent PL	GL	RN	RF	Density Age 0+	Age ½+
Scott Creek									
Jul – Sep	1988	14	3535	41	25	21	12	57	7
Aug – Oct	1992	13	1624	66	30	4	0	89	21
Jan	1994	11	1554	49	32	19	0	39	21
Aug	1994	13	1744	59	36	6	0	52	18
Oct	1995	12	1686	59	32	8	1	90	10
Oct – Nov	1996	12	1684	62	30	8	1	35	20
Aug – Sep	1997	13	1865	64	24	11	0	68	7
Sep – Oct	1998	11	1753	77	16	6	1	113	10
Oct	1999	10	1430	81	17	2	0	62	10
Sep – Oct	2000	10	1810	81	13	6	0	78	7
Sep – Oct	2001	12	2024	80	18	20	0	52	8
Waddell Creek									
Jun – Aug	1988	8	1817	54	19	23	5	45	7
Jul – Aug	1992	13	2858	67	31	2	0	56	10
Oct – Dec	1993	12	1857	38	21	28	14	54	8
July	1994	12	2367	66	24	7	2	61	19
Sep	1995	12	2498	64	24	10	2	79	14
Aug – Sep	1996	14	2491	69	21	8	2	62	15
Aug – Sep	1997	11	1873	58	32	8	1	71	7
Sep – Oct	1998	10	2083	76	18	5	1	80	7
Oct	1999	10	1558	78	19	4	0	27	4

Table 5 (continued)

Stream and Date	Number of Sites Sampled	Length (feet)	Habitat Percent PL	GL	RN	RF	Density Age 0+	Age 1/ 2+
Sep – Oct 2000	8	1511	65	19	13	3	30	3
Sep – Oct 2001	10	2234	81	14	2	3	24	4
Gazos Creek								
Aug 1992	2	275	44	56	0	0	24	12
Jan 1994	4	503	65	22	12	1	29	9
Nov 1995	4	425	58	19	21	3	68	14
Sep 1996	5	830	49	27	12	13	34	12
Aug 1997	5	827	45	28	17	10	36	8
Aug – Sep 1998	8	1529	65	14	11	10	53	7
Sep – Oct 1999	9	1475	79	18	2	1	51	8
Sep – Oct 2000	7	1036	75	15	10	0	37	6
Sep 2001	10	1791	77	21	2	+	45	11
Redwood Creek								
Jun – Sep 1992	4	1032	37	40	5	7	23	4
Jun – Aug 1993	4	951	48	25	18	9	56	4
Oct 1994	5	1018	83	10	4	3	34	6
Aug 1995	4	796	41	30	19	10	96	4
Nov 1996	3	604	51	31	11	7	33	11
Sep – Oct 1997	5	984	72	18	9	1	15	5
Oct 1998	5	1174	59	25	15	1	47	4
Oct 2000	6	1077	71	27	3	0	39	15
Oct 2001	5	956	78	15	0	7	6	6

Table 6. Densities of YOY steelhead (number per 100 feet) at sites on Waddell Creek in 1995-2001. In 1996 coho were also common and those totals are included with the YOY steelhead for that year. (*Indicates values that are >20% below 1995-1998 low and also > 40% below 1995-1998 mean).

Site		Mile > Hwy 1	1995	1996	1997	Year 1998	95-98 Mean	1999	2000	2001
10	Tributary @ bridge	4.7	74	54	74	45	57	39	--	42
9	Mill Site	3.9	47	60	53	51	53	44	--	20*
8	West Fork > confluence	3.3	53	42	51	60	60	36?	46	14*
7	East Fork > confluence	3.2	76	43	49	115	71	67	51	21*
6	Camp Herbert	3.1	128	51	42	81	76	57	9*	10*
	lower							7*		
5	Pullout < Camp Herbert	2.6	138	94	84	83	100	8*	23*	10*
4	Periwinkle	2.2	139	150	108	123	130	9*	16*	1*
3	Twin Redwoods Camp	1.8	69	81	92	53	74	9*	29*	27*
2	<Alder Camp	1.35	78	121	109	131	110	10*	46*	54*
1	First Bridge	0.6	54	85	--	54	64	8*	18*	36*

Table 7. Coho and steelhead killed and captured (/) by electroshocking and mortality rate (%) on Scott, Waddell, Gazos and Redwood creeks in September and October 2001.

	Steelhead				Coho	
	Age 0+ Kill/Capt	%	Age 1+ Kill/Capt	%	Age 0+ Kill/Capt	%
Scott Creek	11 / 904	1.2	0 / 148	0	0 / 12	0
Waddell Creek	1 / 501	0.2	0 / 82	0	0/ 13	0
Gazos Creek	5 / 710	0.7	0 / 186	0	0	0
Redwood Creek	0 / 13	0	0 / 25	0	0 /169	0
Totals	16 / 2128	0.8	0 / 441	0	0 /194	0
Overall			16 / 2763	0.6		

Figure 1. Standard Lengths (mm) of YOY steelhead from three Scott Creek sites in September and October 2000 and 2001. Site 2 sizes were typical of Scott Creek sites 2-7 and lower Big Creek. Site 11 sizes were typical of Scott Creek sites 8-11 and lower Mill Creek.

	Site 1		Site 2		Site 11	
	2000	2001	2000	2001	2000	2001
25 – 29					1	
30 – 34				3		1
35 – 39			*5	*7	*8	*4
40 – 44		2	***17	*****29	****22	2
45 – 49	1	*8	*****28	******30	******32	****14
50 – 54		***19	***16	*******37	**12	**6
55 – 59	**8	*****28	****21	***16	*8	*3
60 – 64	**7	****24	***15	**14	*4	*3
65 – 69	**6	***18	**7			1
70 – 74	**7	**12	**7	2		
75 – 79	1	*7	1			
80 – 84		4	2			
85 – 89	1	3				
90 – 94	1					
95 – 99	*3					

Figure 2. Standard lengths (mm) of YOY steelhead from two Waddell Creek sites and two Gazos Creek sites in September – October 2000 and 2001. Site 2 sizes on Waddell Creek were typical of main stem sites (1-6). Site 8 sizes on Waddell Creek were typical of West Fork sites. Site 4 sizes on Gazos Creek were typical of upper Gazos Creek sites 3 – 7A.

	Waddell Creek				Gazos Creek			
	Site 2		Site 8		Site 1		Site 4	
	2000	2001	2000	2001	2000	2001	2000	2001
35 – 39			3					*8
40 – 44			****12					***16
45 – 49			******19	*3			**10	*******38
50 – 54			******18	*5		*5	*****24	*****26
55 – 59	2	2	*****15	***10	1	******19	*****22	**14
60 – 64	*5	***9	****12	*5		****12	**13	4
65 – 69	**7	***9	**7	*5	*3	***9	*7	1
70 – 74	****13	*******21	*3	*4	****12	*4	*6	
75 – 79	***11	****13	*3		*4		1	
80 – 84	**7	**6			1			
85 – 89	2	**7			2			
90 – 94	**8	*3						
95 – 99	1							

Figure 3. Standard Lengths (mm) of YOY steelhead from Scott Creek in October 1995, September 1997, October 1998, October 1999, September and October 2000 and September and October 2001. (Years arranged from driest to wettest)

	Sites A&1 2001	Site 1 2000	Sites A&1 1999	Sites A&1 1997	Site A 1995	Site 1 1998
40 – 44	2			*4		
45 – 49	*9		**6	**8		
50 – 54	*****25	1	***10	*****15	1	2
55 – 59	*******36	**8	**8	*****16	*7	*****23
60 – 64	*****29	**7	***9	******18	**11	*******36
65 – 69	*****25	**6	2	*****15	*****29	*******36
70 – 74	**13	**7	*5	***11	***19	*******38
75 – 79	*9	1	2	***10	****20	**10
80 – 84	*6			*3	**13	3
85 – 89	3	1			**12	*9
90 – 94		1	1		*8	3
95 – 99		*3	1		3	3
100-104					4	

	Site 2 2001	Site 2 2000	Site 4 1999	Site 2 1997	Site 2 1995	Site 2 1998
30 – 34	3		2			
35 – 39	*7	*5	4	*4	4	1
40 – 44	*****29	***17	*8	****12	******33	*5
45 – 49	******30	*****28	***17	******18	*****29	*****22
50 – 54	*******37	***16	*****27	*****17	*****25	*********48
55 – 59	***16	****21	***18	******18	***19	**********50
60 – 64	**14	**15	***17	****13	*****27	*******35
65 – 69		*7	*6	1	***16	***16
70 – 74	2	*7	3	*4	***16	**10
75 – 79		1		1	**11	*5
80 – 84		2			2	1

	Sites 9&11 2001	Site 11 2000	Site 11 1999	Sites 9&11 1997	Sites 9&11 1995	Sites 9&11 1998
25 – 29		1				
30 – 34	2		1	3	*5	*5
35 – 39	**7	*8	***10	****22	***17	****20
40 – 44	**7	****22	***11	*******38	*****25	********45
45 – 49	*****17	******32	****12	******34	****23	********44
50 – 54	********24	**12	***10	******31	*****26	********48
55 – 59	***10	*8	**8	******31	***19	*****26
60 – 64	*5	4	*3	***14	*9	**14
65 – 69	1	1	*3	**10	4	**11
70 – 74	1	2	1		2	1

Figure 4. Standard lengths (mm) of YOY steelhead from sites on Gazos Creek in September and October 2000.

	Site 1 mile 0.9	Site 2A mile 2.1	Site 2B mile 2.8	Site 3 mile 3.15	Site 4 mile 4.4	Site 5 mile 4.8	Site 7 mile 5.3
45 – 49					**10	1	*7
50 – 54				***9	****24	**8	******32
55 – 59	1	*4	*3	******18	****22	******18	********40
60 – 64		***10	**7	***10	**13	**8	****24
65 – 69	*3	****13	*****16	**7	*7	*5	**13
70 – 74	****12	**8	**6	*5	*5	*3	*5
75 – 79	*4	**6	2	2		1	4
80 – 84	1	1	2				4
85 – 89	2						3

Figure 5. Standard lengths (mm) of YOY steelhead from sites on Gazos Creek in September 2001.

	Site 1 mile 0.9	Site 2A mile 2.1	Site 2B mile 2.8	Site 3 mile 3.15	Site 4 mile 4.4	Site 5 mile 4.8	Site 7 mile 5.3
30 – 34				1			
35 – 39				*8	*8	1	
40 – 44		*6	**6	******32	***16	*5	
45 – 49		**12	**6	********39	********38	*3	2
50 – 54	*5	*****26	***9	*****28	*****26	**6	********20
55 – 59	******19	***16	**6	***19	**14	*5	***11
60 – 64	****12	**10	***11	*5	4	*4	****13
65 – 69	***9	*8	*5	4	1		**6
70 – 74	*4	2	2	1			2

Figure 6. Standard Lengths (mm) of YOY steelhead at downstream (sites 1&2) and upstream (site 4) sites on Gazos Creek from 1995 to 2001.

	Sites 1&2 1995	Sites 1&2 1997	Sites 1&2 1998	Site 1 1999	Site 1 2000	Site 1 2001
40 – 44		2	1			
45 – 49		2	******18			
50 – 54	2	****13	*********28			*5
55 – 59	****12	******18	******18		1	******19
60 – 64	*******22	****13	**********33	*3		****12
65 – 69	********24	**6	****12	***9	*3	***9
70 – 74	****12	***11	*3	***11	****12	*4
75 – 79	****14	**6	*3	***11	*4	
80 – 84	****12	2		*3	1	
85 – 89	**6			*3	2	

	Site 4 1995	Site 4 1997	Site 4 1998	Site 4 1999	Site 4 2000	Site 4 2001
30 – 34		2		1		
35 – 39	2	*5	1	2		*8
40 – 44	**6	****14	****14	****23		***16
45 – 49	****13	****13	**********33	*******39	***10	*******38
50 – 54	*****15	******20	********25	****27	********24	*****25
55 – 59	***9	****14	*****17	****21	*******22	**14
60 – 64	*5	****12	**7	***16	****13	4
65 – 69		*4	*4	*5	**7	1
70 – 74					**6	